

# **MISSOURI DEPARTMENT OF NATURAL RESOURCES**



## **CLEANUP LEVELS FOR MISSOURI (CALM) - Introduction**

**Table of Contents, Overview, Instructions,  
Sample Forms & Reports, and References**

**Division of Environmental Quality  
Hazardous Waste Program**

**Revised June 29, 2001**

**TABLE OF CONTENTS**

APPENDICES .....	ii
LIST OF FIGURES.....	ii
LIST OF TABLES.....	ii
ATTACHMENTS.....	iii
ABBREVIATIONS.....	iii
1. INTRODUCTION.....	1
2. OVERVIEW OF CALM.....	1
3. REACHING SITE CLOSURE WITH CALM.....	3
3.1 Site Assessment/Characterization.....	4
A. Groundwater Contamination Originating From Off-Site Sources .....	6
3.2 Site Classification: Determining the Site's Land Use/Exposure Scenario .....	6
3.3 Tier 1 Analysis .....	9
A. Default Assumptions .....	10
B. Alternatively Derived Cleanup Levels.....	10
C. Exposure Pathways.....	11
D. Risk Level.....	11
E. Cumulative Risk.....	11
3.4 Tier 1 Decision Point.....	12
3.5 Tier 2 Analysis.....	13
3.6 Tier 2 Decision Point.....	15
3.7 Tier 3 Analysis.....	15
3.8 Tier 3 Decision Point.....	18
3.9 Remedial Action.....	18
A. Preparation of Remedial Action Plan (RAP).....	18
B. Review and Approval of RAP.....	19
C. Implementing the RAP.....	20
D. Monitoring.....	20
3.10 Final CALM Report.....	21
3.11 Certification of Completion: the No Further Action Letter.....	23
REFERENCES.....	27



## APPENDICES

Appendix A - Formulas for Calculating Tier 1/Tier 2 Soil Target Concentrations .....	A1
Appendix B - Tier 1 Cleanup Levels .....	B1
Appendix C - Tier 2 Cleanup Levels .....	C1
Appendix D - Tier 3 Models and Methodologies .....	D1
Appendix E - Institutional Controls and Administration.....	E1
Appendix F - Ecological Risk Assessment.....	F1
Appendix G -Engineering Controls.....	G1
Appendix H - CALM Examples.....	H1

## LIST OF FIGURES

Figure 1	Overview of CALM Process .....	2
Figure 2	Flow Chart for Site Scenario Determination .....	8
Figure A1	Simplifying Assumptions for the Soil Leaching to Groundwater Pathway .....	A9
Figure A2	Simplifying Assumptions for the Advection/Dispersion/Degradation Equation .....	A9
Figure A3	Summary of Formula Parameters Which May be Modified at Tiers 2/3 .....	A10
Figure B1	Flow Chart for Determining Tier 1 Soil Target Concentrations.....	B4
Figure B2	Applying $C_{LEACH}$ and $C_{IDI}$ to the Soil Column.....	B5
Figure B3	Screening Level For Lead Program Model Parameters and Defaults.....	B15
Figure B4	IEUBK99D Model Parameters and Defaults.....	B15
Figure E1	Institutional Controls & Public Participation Requirements .....	E3
Figure F1	Qualitative Screening process for an Ecological Exposure Analysis .....	F3
Figure F2	Checklist for Potential Receptors and Habitat.....	F11
Figure F3	Checklist of Exposure Pathways .....	F11
Figure G1	Surface Cap Information Requirements.....	G2
Figure H1	Plate-n-Stuff Site Map .....	H3
Figure H2	ChemWood Site Map.....	H7

## LIST OF TABLES

Table 1	Examples of Site Conditions Posing Imminent and Substantial Endangerment Threat to Human Health, Safety, or the Environment, and Corresponding Potential Immediate Response Actions.....	9
Table A1	CALM Formulas.....	A1
Table A2	CALM Formula Parameters and Assumptions.....	A6
Table A3	Toxicological Values.....	A12
Table A4	Chemical Property Values.....	A19



Table B1	Soil and Groundwater Target Concentrations (STARC and GTARC).....	B23
Table C1	Site-Specific Variables Which May be Measured in the Field.....	C3
Table C2	Calculated Values Subject to Change with use of Site-Specific Inputs.....	C4
Table C3	Chromium Soil Target Concentrations.....	C10
Table C4	PCB Soil Target Concentrations.....	C11
Table C5	Degree of Chlorination for Aroclor Mixtures.....	C12
Table C6	Relative Potency Factors for Polynuclear Aromatic Hydrocarbons.....	C13
Table E1	Institutional Controls and Public Participation Requirements.....	E3
Table F1	Wetland Habitats.....	F9
Table F2	Considerations for Evaluating Aquatic Habitats.....	F9
Table F3	Considerations for Evaluating Terrestrial Habitats.....	F10
Table H1	Comparison of Plate-n-Stuff Soil Contaminant Levels to Cleanup Targets.....	H4
Table H2	Comparison of Plate-n-Stuff Groundwater Levels to Cleanup Targets.....	H4
Table H3	Comparison of ChemWood Soil Contaminant Levels to Cleanup Targets.....	H6
Table H4	Comparison of ChemWood Groundwater Levels to Cleanup Targets.....	H8
Table H5	Modifications to Tier 1 Formula Default Values.....	H8
Table H6	Comparison of ChemWood Soil Contaminant Levels to Tier 2 C <sub>LEACH</sub> .....	H9
Table H7	Comparison of Barrel Busters Soil Contaminant Levels to Tier 3 Cleanup Targets.....	H12
Table H8	Comparison of Barrel Busters Groundwater Contaminant Levels to Tier 3 Groundwater Targets.....	H13

## ATTACHMENTS

Attachment 1	Example (Generic) VCP Certification of Completion.....	24
Attachment 2	Example (Generic) VCP Certification of Completion with Restrictive Covenant.....	25
Attachment E1	Model Restrictive Covenant and Grant of Easement.....	E15
Attachment E2	Model Paragraphs For Use in Restrictive Covenant.....	E21
Attachment E3	Model Recision of Restrictive Covenant.....	E26
Attachment E4	Model Amendment/Modification of Restrictive Covenant.....	E28
Attachment E5	Model VCP Institutional Control Contract.....	E30



---

**ABBREVIATIONS**

$C_{\text{IDI}}$	Soil target concentration for the combined ingestion/dermal contact/inhalation exposure pathways
$C_{\text{LEACH}}$	Soil target concentration for the leaching to groundwater followed by groundwater ingestion exposure pathway
CALM	Cleanup Levels for Missouri
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act (P.L. 96-510)
DOH	Missouri Department of Health
DNR	Missouri Department of Natural Resources
EPA	US Environmental Protection Agency
ERA	Ecological risk assessment
GTARC	Groundwater target concentration
HEAST	Health effects assessment summary tables
IDI	Ingestion/dermal contact/inhalation pathways
IRIS	Integrated risk information system
MCL	Maximum contaminant level
OSHA	Occupational Safety and Health Administration
PEL	Permissible exposure level
STARC	Soil target concentrations
SAC	Site assessment/characterization
SPLP	Synthetic Precipitation Leaching Procedure (EPA SW-846 Method 1312)
TARC	Target Concentration
TCLP	Toxicity Characteristic Leaching Procedure (EPA SW-846 Method 1311)
TLV	Threshold limit value
USEPA	United States Environmental Protection Agency
US	Underground storage tank
VCP	Missouri's Voluntary Cleanup Program



## 1. INTRODUCTION

The Cleanup Levels for Missouri (CALM) guidance document outlines a process for determining cleanup goals at sites with known or suspected hazardous substance contamination. CALM is intended to replace its predecessor guidance document “How Clean Is Clean? Uniform Cleanup Standards For Contaminated Sites in Missouri,” last revised in April, 1995. The CALM process was developed for hazardous substance contamination which is remediated under Missouri’s Voluntary Cleanup Program (VCP) laws and regulations (10 CAR 25-15.010<sup>1</sup>) administered by the Missouri Department of Natural Resources’ Hazardous Waste Program<sup>2</sup>. The document sets forth a consistent decision-making process for assessing and responding to contaminated sites in Missouri which are being addressed through the VCP. The cleanup goals for soil and groundwater are intended to protect human health and the environment. The general sequence prescribed by CALM is shown in the CALM Overview Flowchart (Figure 1).

Contaminated sites vary greatly in terms of complexity, physical and contaminant characteristics, exposure factors, and in the risk that they may pose to human health and the environment. The CALM process recognizes this diversity by developing cleanup levels based on actual or potential risks considering various site land use scenarios and by using a tiered approach that integrates site assessment and response actions with human health and ecological risk assessment.

As a guidance document, CALM does not hold the force of law or regulation, and is not intended to supersede any laws or regulations for any site or release. Currently, within the department, CALM may be used only for setting cleanup goals for sites undergoing cleanup in the department’s Voluntary Cleanup Program. Federal, state or local agency laws and/or regulations may apply to the cleanup of some sites. It is the user’s responsibility to be aware of these laws and regulations, and to attain all applicable approvals and permits.

## 2. OVERVIEW OF CALM

The main body of this document provides an overview of the process for determining soil and groundwater cleanup levels for contaminated sites. A site may be evaluated under any of the three “tiers”. The tiers provide various levels of flexibility, allow various levels of site-specific data input, and provide either pre-determined or site-specific cleanup targets for the contaminants of concern. Remediation conducted to cleanup levels developed under any of the three tiers is intended to provide an equal level of protection for human health and the

---

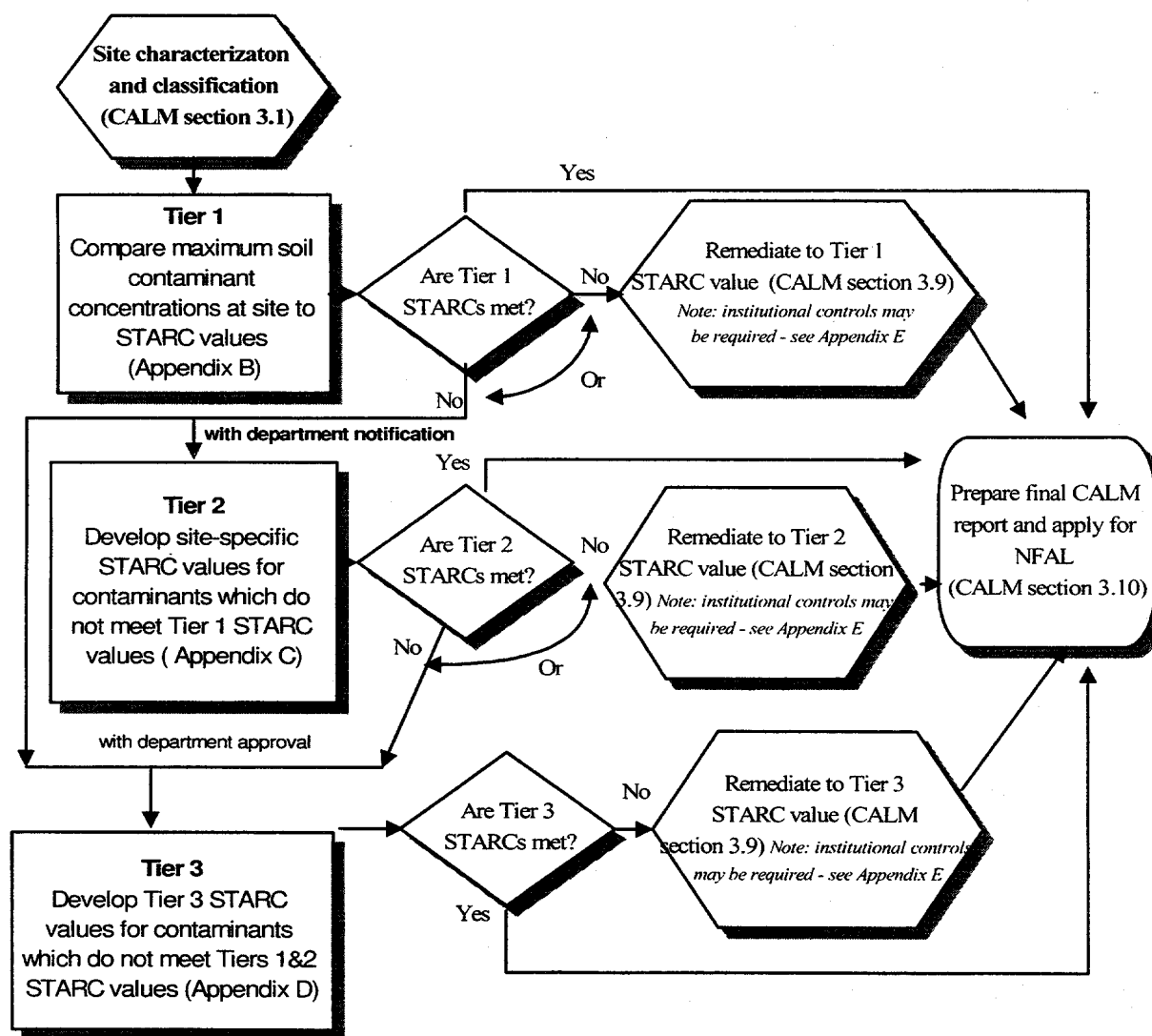
1 The Voluntary Cleanup Law (formally known as the Hazardous Substance Environmental Remediation Law) is found in the Revised Statutes of Missouri, § 260.565 -- 260.575, and the Hazardous Substance Environmental Remediation administrative rule is in 10 CAR 25-15.010.

2 All Missouri regulations are cited in the following manner: title number, CAR (the abbreviation for the Code of State Regulations), division number, hyphen, chapter number, point, rule number. 10 CAR 25-15.010 refers to Title 10 of the Code of State Regulations, Division 25, Chapter 15, rule number 15.010.



environment. The CALM process is briefly illustrated in the flow chart in Figure 1. Detailed information on the various steps and the use of each of the three tiers, and Tier 1 lookup tables are given in the Appendices.

**Figure 1 Overview of CALM**



**Features Of The CALM Approach**

- ▶ Promotes high quality, effective, and efficient cleanups;
- ▶ Ensures that the remedial action is protective of human health, safety and the environment by achieving an acceptable level of exposure and risk reduction;
- ▶ Decisions are based on reducing the risk of potential adverse human health and environmental impacts;
- ▶ Allows completion to be evaluated relative to reasonable potential exposure scenarios and site-specific standards and points of compliance;
- ▶ Considers exposure differences arising from varying land use scenarios in the setting of cleanup goals;
- ▶ Allows users the flexibility of determining cleanup levels either by using simple look-up tables or by developing site-specific cleanup levels; and
- ▶ Includes provisions for the use of institutional and engineering controls to ensure that any contamination remaining in place will not pose a future threat.

**3. REACHING SITE CLOSURE WITH CALM**

The CALM process is a three-tiered approach generally requiring increasingly sophisticated data collection and analysis as the user proceeds through the tiers. Cleanups conducted under Tier 1 are done to a pre-set generic look-up table value determined using conservative default assumptions about the site. At Tier 2 or Tier 3 default assumptions may be replaced or augmented with additional site-specific data and information to calculate cleanup targets which are tailored to the site.

The technical analyses and decisions required by CALM should be conducted by persons familiar with current site characterization techniques, remediation science and technology, risk and exposure assessment methodologies, and toxicology. The department may place time constraints on individuals using the CALM process; for example, requiring that a particular tier evaluation be completed within a certain time period.

It is not necessary in all cases to start at Tier 1 and progress sequentially through the tiers. For some sites, the user may start out in Tier 1 but may find it desirable to progress to the higher tiers after initial site assessment indicates that the investment in additional site-specific analysis and data gathering is warranted. Still other sites may essentially enter directly into the upper tiers after determining that contaminant levels at the site exceed the Tier 1 standards. Users of CALM may consult with the department on which tiers are appropriate for a given site.

If a cleanup is done to levels other than unrestricted use (Scenario A levels, see Section 3.2), land use restrictions must be recorded in a restrictive covenant placed in the property chain of title. Similarly, if engineering controls such as caps or other barriers are used, their integrity must be assured through a restrictive covenant. Both types of restrictive covenants must also





be accompanied by a monitoring/inspection contract with the department. See Appendices E and F for further details.

In order to properly apply the CALM process, the following pointers should be considered. This list is not intended to be all-inclusive.

#### Pointers for Using CALM

- ▶ Involve local zoning and other officials early in the process;
- ▶ Refer to and comply with the public notice provisions described in Appendix E;
- ▶ Conduct active remediation only with prior department approval, unless it is necessary to mitigate immediate threats to human health or the environment;
- ▶ Proceed to a Tier 2 evaluation only after notifying the department;
- ▶ Proceed to a Tier 3 evaluation only after obtaining written approval from the department;
- ▶ Use modeling and methodology which is supported by available data and knowledge of site conditions, and which is approved by the department, in order to determine target cleanup levels;
- ▶ Use values for equation variables which are approved by the department in order to determine target cleanup levels;
- ▶ Use exposure factors and toxicity parameters which are approved by the department in order to obtain target cleanup levels;
- ▶ Consider aesthetic and other criteria which may make a site resource unusable (e.g., taste in groundwater, off-site odor, etc.), when generating cleanup targets;
- ▶ Consider additive effects when screening multiple contaminants;
- ▶ Never use the CALM process only as a means to try to justify not conducting active remediation;
- ▶ Consider all options in addition to source removal and treatment actions, including other exposure reduction options, such as engineering and institutional controls, alternate exposure and compliance points, sequencing remediation activities at multiple sites on the same facility, etc.; and
- ▶ Consider the need for and cost of ongoing maintenance of engineering or institutional controls (see Appendix E).

### 3.1 Site Assessment/Characterization

The principal objectives of the site assessment/characterization (SAC) are to identify and characterize the nature, horizontal and vertical extent, direction, volume, potential movement, and composition of contamination in the various environmental media at the site. Potentially significant contaminant transport pathways (e.g., groundwater flow, utility conduits, atmospheric dispersion, etc.) should also be investigated. This information and data is gathered both from examination of historical information sources (Phase I-type assessment), and from invasive on-site investigations (Phase II-type assessment). If it has been determined that potential ecological receptors are present, the user should collect sufficient information to characterize ecological exposure pathways as described in Appendix F. Site assessment/characterization techniques and



methodology are provided in the References section at the end of this document. The department intends to draft a separate site assessment/characterization document in the near future which will provide more detail on the department's expectations for adequate SAC.

The site assessment/characterization may be limited to gathering only the information necessary to complete the CALM process tasks for the Tier of interest. The SAC data should be summarized using a clear and concise format in a report submitted to the department for review. The site assessment/characterization information for a Tier 1 evaluation may include, but might not be limited to the following items:

<b>Elements of a Site Assessment/Characterization</b>	
▶	A visual inspection for obvious environmental impacts, and for initial screening for potential human and/or ecological receptors (e.g., workers, residents, aquatic organisms, etc.);
▶	A review of historical records of past land uses, site activities and past releases;
▶	Identification of the contaminants of concern in various environmental media;
▶	Location of major sources and estimates of total contaminant mass/volume, if possible;
▶	Location of maximum contaminant concentrations in different media (e.g. soil, surface water, sediments, ground water);
▶	Determination of naturally-occurring (non-anthropogenic) background concentrations of contaminants of concern in environmental media, if applicable;
▶	Determination of the vertical and horizontal extent of both soil and groundwater contamination;
▶	Location of human and ecological receptors that could be impacted (points of exposure);
▶	Identification of potentially significant transport and exposure pathways (e.g., ground water transport, vapor migration through soils and utility conduits, etc.);
▶	Determination of current or reasonably anticipated future use of the site and surrounding land, ground water, and surface water;
▶	Determination of regional and local hydrogeologic and geologic characteristics (e.g., depth to ground water, aquifer thickness, flow direction, gradient, description of confining units and ground water quality);
▶	Preparation of a qualitative or screening level evaluation of impacts to ecological receptors, including identification of potentially complete exposure pathways and indicators of adverse impacts (e.g., stressed vegetation), using Appendix F as a guide; and
▶	Preparation of a conceptual site model illustrated both graphically and by narrative description.

As the site is evaluated with respect to the requirements and benefits of each tier, the user and/or the department should review the results, and determine whether a more site-specific analysis at a higher tier is warranted. Since additional rounds of site assessment



build on data gathered earlier in the process, the quality of the data collected during the site characterization provides the basis for the subsequent quality of CALM cleanup targets and decisions.

As the user gathers data, site conditions should be evaluated to determine the immediacy of the risks posed by the site. Table 1 presents examples of site conditions which constitute imminent and substantial endangerment to human health, safety, or the environment, along with example immediate responses. These are only included as examples in order to provide the user with a frame of reference. The examples in Table 1 do not represent a complete list of potential site conditions which constitute these endangerment threats. It should be noted that, as stated in Missouri's Voluntary Cleanup statute and regulations, sites which pose imminent and substantial endangerment to human health, safety, or the environment are not eligible for remediation under the Voluntary Cleanup Program, and will be handled elsewhere within the department.

#### **A. Groundwater Contamination Originating From Off-Site Sources**

It is possible during site assessment/characterization that an owner of a site will find contaminated ground water under their property which is not attributable to current or past activities on that property. In such cases the department will require the participant to document through sampling that the contamination is being transported under the property from off site. The department will also require that soil samples from the participant's property be analyzed to show that the property is not the source of, and is not contributing to, the contamination.

If the property owner can demonstrate to the department's satisfaction that the subject property is neither the source of, nor a contributor to, the contamination, and actions at the subject property have not exacerbated the contamination, the department will not hold the owner of the subject property responsible for remediation of that contaminated groundwater. The department will require institutional controls that provide notice to future land owners, and prevent future exposure to the contaminated groundwater.

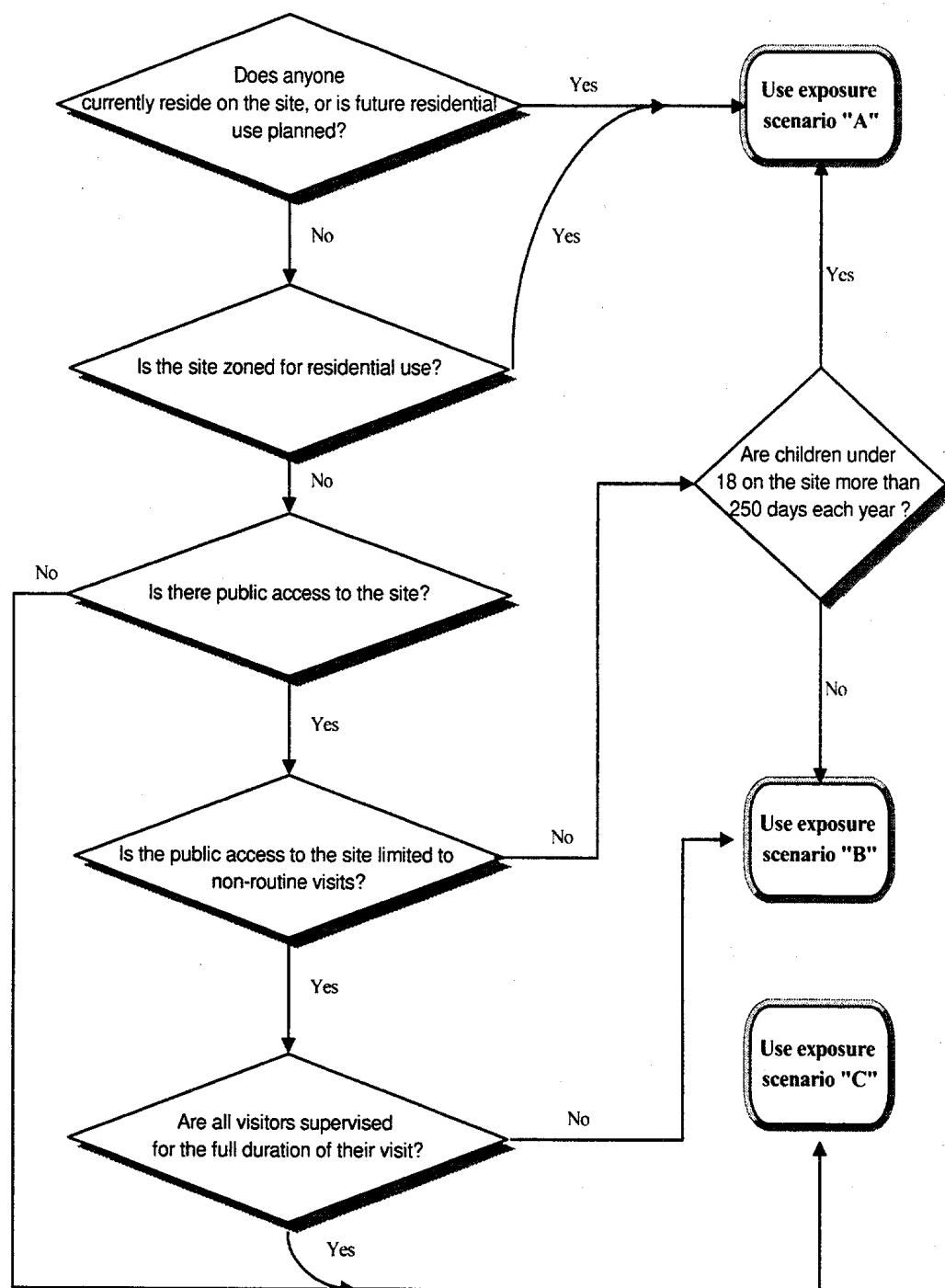
### **3.2 Site Classification: Determining the Site's Land Use/Exposure Scenario**

The site exposure scenario is used to determine which of three Tier 1 soil target concentrations (STARCs) applies to the site for each contaminant of concern. Appendix B contains the Tier 1 STARC look-up table and discussion of how the values were calculated. The value of the STARC look-up table is that users do not have to repeat the exposure calculations for each exposure scenario and contaminant encountered. The look-up table will be revised by the department when exposure parameters, toxicological information, or recommended methodologies are updated.



Information collected during the site characterization is used to classify sites by defining the site's exposure scenario using the flow chart in Figure 2. Sites are classified with respect to the potential for on- and off-site exposures. The site exposure scenario should reflect the current and reasonably anticipated future use of the site. Determining a site's exposure scenario may require contact with and approval by local zoning officials. An open dialog with nearby land owners is also encouraged. Sites should be re-classified with regard to both these considerations if conditions at the site change or if better information becomes available.

Figure 2 provides a flowchart for use as guidance in determining a site scenario classification. Please note that this flow chart is not intended to be all-inclusive. Uncommon or unusual site specific conditions may warrant classifying certain sites differently than through strict adherence to these criteria and definitions. Final determination of the appropriate site classification must be approved by the department. Institutional controls will be required for any sites cleaned up to Scenario B or C (restricted use) standards.

**Figure 2. Land Use Scenario Flowchart**



**Table 1. Examples of Site Conditions Posing Imminent and Substantial Endangerment Threat to Human Health, Safety, or the Environment, and Corresponding Potential Immediate Response Actions**

Site Condition	Example Immediate Response Actions
<ul style="list-style-type: none"><li>Explosive levels, or concentrations of vapors that could cause acute health effects, are present in a building.</li></ul>	<ul style="list-style-type: none"><li>Evacuate occupants, begin abatement measures such as subsurface ventilation, or building pressurization.</li></ul>
<ul style="list-style-type: none"><li>Explosive levels of vapors are present in subsurface utility systems, but no building or residences are impacted.</li></ul>	<ul style="list-style-type: none"><li>Evacuate immediate vicinity, begin abatement measures such as ventilation.</li></ul>
<ul style="list-style-type: none"><li>Non-aqueous phase liquids (NAPL) are present in significant quantities and with mobility sufficient to pose an immediate threat to human or ecological receptors (e.g. seepage into surface waters, buildings, supply wells, etc.)</li></ul>	<ul style="list-style-type: none"><li>Prevent further NAPL migration by appropriate containment measures, institute NAPL recovery, restrict area access.</li></ul>
<ul style="list-style-type: none"><li>An active public water supply well or line, or public surface water intake is impacted or immediately threatened.</li></ul>	<ul style="list-style-type: none"><li>Notify users, provide alternate water supply, hydraulically control contaminated water, and treat water at point-of-use.</li></ul>
<ul style="list-style-type: none"><li>Ambient vapor/particulate concentrations exceed concentrations of concern from an acute exposure or safety viewpoint.</li></ul>	<ul style="list-style-type: none"><li>Install vapor barrier (e.g., capping, foams, etc.), remove source, or restrict access to affected area.</li></ul>
<ul style="list-style-type: none"><li>A sensitive habitat or sensitive resources (e.g. sport fish, economically important species, threatened and endangered species) are impacted and affected.</li></ul>	<ul style="list-style-type: none"><li>Minimize extent of impact by containment measures and implement habitat management to minimize exposure.</li></ul>
<ul style="list-style-type: none"><li>Acute concentrations of contaminants of concern have been measured in uncovered/unpaved surface soils.</li></ul>	<ul style="list-style-type: none"><li>Prevent direct contact by installing a barrier (e.g., fence, cover, cap, etc.).</li></ul>

### 3.3 Tier 1 Analysis

In Tier 1, the user should first gather the information necessary to determine the appropriate cleanup levels for the site, and then compare the site contaminant levels to the cleanup levels. The following steps summarize the major steps in the Tier 1 process:

1. Complete the site assessment/characterization (3.1).
2. Determine the exposure scenario (A, B, or C) that applies to the site (3.2).
3. Conduct qualitative ecological risk assessment (Appendix F)
4. Determine Tier 1 cleanup levels (Appendix B).
5. Go to section 3.4, "Tier 1 Decision Point".



The user should determine a Tier 1 cleanup level for each contaminant of concern under the exposure scenario which is appropriate to the site, as described in Appendix B. Several assumptions were made regarding soil and groundwater characteristics, and these are listed in Appendix A Table A2. The Tier 1 look-up table values may change as new methodologies and parameters are developed. Once the user has determined the relevant Tier 1 soil targets (STARC) and, if necessary, groundwater targets (GTARC) for the site, the values are compared to the contaminant levels measured on-site during the site assessment/characterization activities. This comparison procedure is described in Appendix B and graphically represented in Figure B1.

### A. Default Assumptions

In order to develop the TARC values found in Appendix B, various assumptions were necessary for the formula variables used. Conservative choices were selected for these variables from within their expected natural range of variation. For example, the fraction of organic carbon ( $f_{oc}$ ) in Missouri soils may vary from 0.1% to 40% depending on the soil horizon and soil type. Lower soil organic carbon content (OC) generally results in more conservative estimates of the soil's contaminant saturation limit ( $C_{sat}$ ) and the soil-leaching-to-groundwater STARC value. In other words, higher OC results in higher cleanup levels, and visa versa. Therefore, an  $f_{oc}$  value of 0.6% was chosen which represents the 5th percentile of  $f_{oc}$  in Missouri; i.e. 95% of Missouri soils contain more than 0.6% organic carbon.

Although the Tier 1 variable assumptions are believed by the department to be reasonable, there are simply too many variables and too much natural variation between sites to adequately represent any single site with a single set of generic values. If the user determines or suspects that site conditions are poorly represented by the assumptions and methodology described in Appendix A which were used to derive the STARC table values, a Tier 2 or Tier 3 evaluation may be justified. Movement to Tier 2 or 3 on this basis may be prompted by either the user or by the department.

### B. Alternatively Derived Cleanup Levels

The target concentration (TARC) table values for a few selected contaminants were developed by alternative methods. For some contaminants, toxicity data is not available, or it varies according to speciation. For others, a strictly health or toxicity-based level may not protect against explosive fumes in utilities or basements, or may present secondary taste and odor problems with drinking water. For these contaminants, the cleanup levels are based on these criteria, and are generally more stringent than health-based values. For some other contaminants, toxicity data was not available for all pathways considered in Tiers



1 and 2, again leading to alternative methods for determining cleanup levels. These alternately-derived cleanup levels are further described in Appendix B and are included in Table B1 (indicated with a 5 or 7 superscript).

### **C. Exposure Pathways**

The TARC table contains soil and groundwater target concentrations for the following exposure pathways: soil ingestion, dermal contact and inhalation, as well as, leaching-to-groundwater and groundwater ingestion. The department chose these exposure pathways because of their potential importance for most sites, however they do not represent all possible exposure pathways that may be present at a site. If additional pathways are discovered or suspected to be significant, the user should consider them in a Tier 2 or Tier 3 investigation.

### **D. Risk Level**

The TARCs reflect values for various exposure pathways and land use scenarios which are calculated to protect human health and the environment. These concentrations were developed based on a human risk level of  $10^{-5}$  for carcinogens and a hazard quotient of 1 for noncarcinogenic contaminants. The calculation methodology is consistent with Missouri Department of Health (MDOH) practices. For each exposure scenario, the levels are based on the exposure parameters described in Appendix A, and current human toxicological information found in the USEPA Integrated Risk Information System (IRIS) Database, Health Effects Assessment Summary Tables (HEAST), peer-reviewed sources and DOH-approved toxicity data. The TARC look-up table will be updated when new data becomes available.

### **E. Cumulative Risk**

The concept of cumulative risk can be thought of as the aggregate risk from all sources to which an individual is exposed. An individual may receive exposures to multiple contaminants or through multiple exposure pathways from a given site. Multiple pathways are addressed in the CALM formulas by mathematically combining risks from each pathway at Tier 1 (ingestion, inhalation, and dermal contact) to generate a cleanup target level for each contaminant which accounts for multiple pathway exposure. If exposure pathways other than those considered at Tier 1 exist at a site, the user should proceed to Tier 2 or Tier 3, and further evaluate these pathways.

Additivity of risk resulting from exposure to multiple contaminants at a given site which affect the same target organ or system may be considered in upper tiers; however, this has not been deemed necessary for Tier 1. The Department of





Health feels that sufficient toxicological data does not yet exist on the additive, synergistic and antagonistic effects of the many combinations of contaminants to make reasonable conclusions regarding cleanup standards at this time. We are therefore relying on the conservatism already built into the Tier 1 assumptions, reference doses, and slope factors to provide a margin of safety until the body of data is sufficient to quantify these effects.

### 3.4 Tier 1 Decision Point

Cleanup targets generated from the Tier 1 analysis are used to determine if site conditions satisfy the criteria for a quick closure (i.e. contaminant levels are below Tier 1 TARC values), warrant remediation, or warrant more site-specific Tier 2 or Tier 3 evaluation. In Tier 1, the points of exposure and points of compliance are assumed to be located at the source areas.

If the user determines that contaminant concentrations are below the Tier 1 cleanup levels, and the department concurs with: a) the scenario determination, b) the user's selection of STARC/GTARC values, and c) the appropriateness of the use of Tier 1 at the site, then no remediation is required. The user may proceed to section 3.10 and follow the guidance for the preparation and submittal of a CALM report.

If site contaminant levels exceed the approved Tier 1 cleanup levels, the user may select from one or more of the following options:

1. Propose a remedial action plan designed to achieve the Tier 1 STARC and/or GTARC values (see section 3.9);
2. Consider institutional and/or engineering controls which may alter the site's land-use scenario determination. Re-evaluate the site under the new scenario as described in Appendix B;
3. Proceed to a Tier 2 analysis after notifying the department;
4. Proceed to a Tier 3 analysis after receiving written approval by the department.  
[Note that the user may conduct interim remedial action (e.g. source removal) with department approval while further evaluating the site.]

If the user is considering proceeding to Tier 2, the following steps should be taken:

1. Analyze the approved Tier 1 cleanup levels and potential remedial action options with respect to items (a) - © below. These conditions support of the use of Tier 2:
  - a) The basis for the Tier 1 assumptions (e.g., geology, exposure parameters, points of exposure, reasonable land use, etc.) are not consistent with the



- site-specific conditions; or
  - b) Cleanup to Tier 1 levels would cause further exposure or create new transport pathways for the contaminants; or
  - c) Engineering or institutional controls planned at the site will close or reduce certain exposure pathways, and alternate cleanup levels based on these controls are expected to be as protective as Tier 1 levels.
2. Notify the department in writing of the intent to proceed to a Tier 2 analysis. The notification should include the site name, decision date, and the name and telephone number of a contact person. Include documentation to support the progression of the site to Tier 2.

Note that the department reserves the option of requiring progression to Tier 2 in the case that it determines the assumptions used to generate the Tier 1 STARC table values do not adequately represent actual site conditions.

### 3.5 Tier 2 Analysis

The site assessment/characterization and Tier 1 analysis information and data are also used at Tier 2. However, additional information may be required in order to support the proposed site-specific Tier 2 calculations. The following are examples of additional data which may be required at Tier 2.

<b>Additional Data Which May Be Required at Tier 2</b>
<ul style="list-style-type: none"><li>▶ Additional site-specific hydrogeologic and geologic characteristics (e.g., depth to ground water, aquifer thickness and yield, flow direction, gradient, description of confining units and ground water quality, type(s) of overburden and bedrock present, <math>f_{oc}</math>, bulk density, etc.);</li><li>▶ Natural (non-anthropogenic) background concentrations of contaminants of concern in environmental media;</li><li>▶ Changes in concentrations of contaminants of concern over time;</li><li>▶ Concentrations of contaminants of concern measured at alternate points of compliance and exposure; and</li><li>▶ Review of Tier 1 exposure pathways to determine if these pathways exist at the site, and/or whether additional pathways should be added.</li></ul>

In a Tier 2 analysis the user may modify the Tier 1 STARCs by using additional site-specific information in place of the pre-determined assumptions used in the Tier 1 formulas to calculate new, site-specific STARC values. Use of Tier 2 for determining cleanup levels for some contaminants identified at a given site but not others is not allowed in CALM. Once progression to Tier 2 (or Tier 3) is made, the entire site must be evaluated under the new tier.




Engineering and institutional controls may be considered when selecting which assumptions to modify in Tier 2. In addition, the user may consider reductions in site exposure which would result from any planned engineering or institutional controls and may modify the Tier 1 exposure scenario (section 3.2) accordingly. It should be noted that engineering controls may result in changes in the point of compliance.

The Tier 2 formulas are located in Table A1 of Appendix A, and a list of all the formula parameters with default values (including those that may be altered in Tier 2 based on site-specific conditions) are provided in Table A2. Engineering and institutional controls, and other site conditions, may be considered when selecting which variables to modify in the Tier 2 formulas.

The qualitative ecological risk assessment conducted in Tier 1 should be re-evaluated using Tier 2 assumptions to determine if a quantitative ecological risk assessment is necessary. If a quantitative ecological risk assessment (ERA) is necessary, the user should petition the department to proceed to Tier 3. Alternately, the department may request progression to Tier 3 if it is determined that a quantitative ERA is necessary. The quantitative ERA generates TARC values which are protective of the ecological receptor(s) identified in the qualitative ERA.

The following are analyses which may be conducted at Tier 2.

<b>Analyses Which May Be Conducted at Tier 2</b>	
	Use of site assessment/characterization data to identify site sources, transport mechanisms, and exposure pathways of interest;
	Development of site-specific STARC values for the contaminants of concern following the guidance in Appendix C;
	Comparison of the site soil contaminant levels to the Tier 2 STARC values and, if ground water is impacted, compare site groundwater levels to the GTARC values;
	Consideration of whether there are any feasible engineering or institutional controls which may (1) change the risk exposure assumptions to provide a different risk exposure scenario, or (2) eliminate or reduce exposure pathway(s) such that the STARC value calculation changes (see Appendix C);
	For very large sites, consideration of whether the site may be partitioned into zones with different exposure scenarios or assumptions as described in Appendix A; and
	Evaluation of remedial action and/or institutional and engineering control options which reduce or eliminate exposure to the contaminants of concern. Combinations of more than one remedial technique may be considered.

Naturally occurring, non-anthropogenic background soil concentrations may be used in Tier 2 when contaminant levels exceed the STARC values but are less than background concentrations. A sampling and statistical analysis plan for the determination of background soil levels should be approved by the department *prior to implementation*. Further details on background sampling may be found in



## Appendix C.

At present, there is only one set of GTARC values (those in Appendix B Table B1). Therefore, at Tier 2, the user must compare groundwater contaminant levels at the site to the Table B1 GTARC values just as in Tier 1.

### 3.6 Tier 2 Decision Point

If the user determines that contaminant concentrations are below the Tier 2 cleanup levels, no remediation is required and the user may proceed to section 3.10 of this document and prepare and submit a final report to the department.

If the user determines that contaminant concentrations exceed Tier 2 cleanup levels, any of the following options may be chosen:

1. Propose a remedial action plan designed to achieve the Tier 2 STARC values (see section 3.9);
2. Propose engineering and/or institutional controls designed to achieve a level of protection equal to or greater than the Tier 2 STARC levels (see Appendices E and G); or
3. Petition the department to progress to Tier 3. The user may not proceed to Tier 3 without prior *written* approval from the department.

Note: if Tier 2 STARC values (calculated using site-specific data in place of the assumptions made at Tier 1) are lower than the Tier 1 STARC values, the user *does not* have the option of using the higher Tier 1 STARC values. Although the Tier 1 values are based on fairly conservative assumptions about exposure and hydrogeological conditions, Tier 2 calculations using site-specific data may in some cases yield even lower cleanup levels than Tier 1. Since these values would be based on data more site-specific than those of Tier 1, they are assumed to be more appropriate for the individual site and would therefore be the best estimate of safe cleanup standards for that site.

### 3.7 Tier 3 Analysis

Tier 3 provides the user with an option to determine TARC values for both direct and indirect pathways using models, formulas, risk and exposure assessment methods, and approaches other than those specified in Tiers 1 and 2. In general, Tier 3 involves a broad range of effort relative to Tiers 1 and 2. It can involve substantially more effort relative to Tiers 1 and 2, as the evaluation can be much more complex and may include additional site assessment, environmental risk assessment, quantitative ecological risk assessment, and sophisticated contaminant fate and transport models. Tier 3 may be entered upon the direction of the department, or department approval of a written request from the user.



The department may require a Tier 3 evaluation if it is determined that using Tier 1 or Tier 2-derived target concentrations would fail to protect human health and the environment. The department will make this determination based on factors which may include, but not be limited to: aesthetic impacts on natural resources, routes of exposure which are not accounted for in Tier 1 or Tier 2 evaluations, inability of Tier 1/2 formulas and equations to adequately represent the site conditions, or failure of Tier 1 or Tier 2 to protect natural or cultural resources. Further guidance on determining when progression to Tier 3 is appropriate is provided in Appendix D. Any Tier 3 analysis must be conducted in accordance with the process described in this appendix.

Tier 3 analysis may involve developing TARC based on the measured and predicted attenuation of the contaminants of concern that migrate away from the source areas, using department-approved mathematical models. Tier 3 allows points of compliance distant from the source areas to be identified in order to take advantage of the natural attenuation of contaminants. However, the point of compliance may be no further from the source area than the site property boundary. The TARC for the source areas and the points of compliance may be based on contaminant fate and transport models and methods other than those used at Tiers 1 and 2, using site-specific input parameters for both direct and indirect exposure scenarios. The TARC values are developed to correspond to concentrations of contaminants of concern at the points of exposure and points of compliance that are protective of human health and the environment.

A Tier 3 analysis commonly involves the collection of significant additional site information beyond that required for Tiers 1 and 2. In addition, statistical evaluation of the data and completion of more extensive (than Tier 2) modeling efforts may be necessary. Tier 3 may also require a more detailed geologic/hydrologic and ecological risk assessment. Data generated in a quantitative ecological risk assessment are used to develop cleanup levels protective of the ecological receptors identified at the site.

A Tier 3 site sampling plan must be submitted to the department for approval prior to beginning any sampling beyond that conducted for the Tier 1 and 2 assessment. The department will review the sampling plan, and either recommend changes or approve the plan.

Following is a list of examples of the types of additional data that may be necessary as part of a Tier 3 analysis.

<b>Additional Data Which May Be Required at Tier 3</b>
<ul style="list-style-type: none"><li>▸ Data required to refine and improve the accuracy of prediction models (e.g., biodegradation rates, etc.);</li><li>▸ Additional geologic/hydrologic data (e.g. from water tracing studies, multi-level groundwater sampling, pump testing, etc.);</li></ul>

**Additional Data Which May Be Required at Tier 3 (cont.)**

- Information to determine alternative points of compliance (e.g., reasonable distance for early warning, physical access constraints between source area and receptor, etc.);
- Data required for the determination of ecological pathways and sensitive ecological receptors, if necessary, as identified in Appendix F; and
- Data regarding changes in morbidity, mortality, and natality of the nearby populations.

In addition to more detailed data requirements, Tier 3 will generally require more advanced contaminant transport, exposure assessment, and toxicological analyses than Tiers 1 and 2. The following are examples of analyses that may be made as part of a Tier 3 evaluation:

**Analyses Which May Be Conducted at Tier 3**

- The use of numerical ground water modeling, as described in Appendix D, to predict contaminant transport and account for heterogeneous subsurface conditions when predicting exposure point concentrations;
- Characterization of site sources and exposure pathways by using site assessment data to identify every relevant source, transport mechanism, impacted media, and exposure pathway. Based on the impacted media identified, the primary sources, secondary sources, transport mechanisms and exposure pathways may be identified;
- Identification of all actual or potential future human and ecological receptors;
- Analysis of those actual and potential receptors for which engineering and/or institutional controls may prevent exposure from occurring;
- Identification of points of compliance which might not be at the source, ensuring that potential receptors are protected at the point of compliance;
- Selection of the most appropriate models as described in Appendix D. Models should be used to evaluate specific hypotheses posed regarding the conceptual model developed for the site by mathematically approximating site and contaminant conditions;
- Consideration of potential exposure pathways not accounted for at Tiers 1 and 2 if appropriate. Use of site assessment/characterization, approved models, and formulas to account for attenuation and movement of each contaminant of concern to develop Tier 3 STARC values.
- Use of quantitative ecological risk assessment information to develop TARC values which will protect current and potential receptors at the point of exposure;
- Comparison of site contaminant levels with Tier 3 STARC and, if appropriate, GTARC values. For each exposure pathway identified, characterization of exposure scenarios for which contaminant concentrations are above the STARC or GTARC levels.
- Consideration of cumulative risks from multiple contaminants in deriving cleanup levels; and
- Selection and documentation of remedial action option(s) considered and those selected which reduce or eliminate exposure to the contaminants of concern at the points of compliance.



### 3.8 Tier 3 Decision Point

If the concentrations of the contaminants of concern are above the Tier 3 target levels at the points of compliance, the user must select one or more of the following:

1. Conduct remedial actions so that contaminant levels at the points of compliance are below the calculated Tier 3 cleanup levels;
2. Conduct interim remedial actions while conducting further site evaluation;
3. Conduct further site evaluation by re-evaluating the assumptions and models used to develop Tier 3 TARC values, collect additional site data, consider additional engineering controls, and use this information to generate a new TARC values for the site.

If the concentrations of contaminants of concern at the points of compliance are less than the approved Tier 3 target levels, and the department agrees that data support the conclusion that concentrations will not be above the target levels in the future, then no additional cleanup activities are necessary, and the user may proceed to section 3.10. Note: if Tier 3 STARC values are lower than the Tier 1 and/or Tier 2 STARC values, the user *does not* have the option of cleaning up to the higher STARC level.

### 3.9 Remedial Action

If the concentrations of contaminants of concern at a site are above the STARC or GTARC at the points of compliance and/or source areas, and the department determines that the remedial action target levels determined by the Tier analysis are appropriate, the user may propose a remedial action plan to meet the approved target levels. After selecting the most appropriate remedial approach from the alternatives considered, the user should develop a detailed remedial action plan. This plan may include some combination of source removal, treatment, and containment technologies, as well as engineering and institutional controls. *The remedial action plan must be approved by the department before implementation*, as required by 10CSR 25-15.010(3)(B) and 15.010(5).

#### A. Preparation of Remedial Action Plan (RAP)

The following steps should be considered in the preparation of a remedial action plan:

Steps in the Selection of a Remediation Method
<ul style="list-style-type: none"><li>▶ Consider interim remedial actions such as source and/or hot spot removal. If the interim remedial actions change the site classification, it may be necessary to reassess the Tier evaluation;</li><li>▶ Identify potential remedial action measures and assess the effectiveness of each option.</li></ul>

**Steps in the Selection of a Remediation Method (cont.)**

This may include pilot testing. Select one or more remedial action options to reduce or eliminate exposure to the contaminants of concern;

- ▶ If more than one remedial technique is being considered, adjust the mix of remedial action measures with the goal of reducing concentrations of contaminants of concern at the points of compliance to levels below the STARC and GTARC values;
- ▶ For remedial actions proposed that will result in soil levels which are above the Scenario A STARC levels or groundwater levels above GTARC, and for which institutional or engineering controls will be used, provide all needed information for the proposed institutional and/or engineering controls. Please see Appendices E & F for further information and requirements for institutional and engineering controls.

**B. Review and Approval of RAP**

When using CALM as part of the State's Voluntary Cleanup Program, the remedial action plan must be submitted to the department for approval prior to beginning the remedial action. The plan must describe:

**Required Components of a Remedial Action Plan**

- ▶ Remedial actions proposed to reduce concentrations of the contaminants of concern to levels below or equal to the approved target levels;
- ▶ Engineering controls proposed to achieve the approved soil concentration targets, to reduce or eliminate exposures, and/or to close exposure and/or transport pathways;
- ▶ Institutional controls proposed to reduce or eliminate exposures, and/or to close exposure and/or transport pathways;
- ▶ A schedule for implementing and completing the proposed actions and installing all engineering and institutional controls;
- ▶ Performance standards for the remedial action, remediation system, or engineering controls with a schedule and criteria for measuring remediation success;
- ▶ Provisions for public notification and involvement (if required), as described in Appendix E, for sites where contaminants of concern will remain in place at levels above scenario A levels;
- ▶ Documentation from public officials, as described in Appendix D, to verify that land uses described in determining the exposure scenario for the site are compliant with local zoning and land use plans;
- ▶ A description of final confirmatory sampling and analysis procedures designed to verify that the remedial measures are successful; and
- ▶ A description of any site monitoring and maintenance that may be necessary (e.g. ongoing groundwater monitoring) after the approved soil concentration targets are achieved.

The department will review the remedial action plan, and either recommend changes or approve the plan. The department will consider factors which may include, but are not limited to, effectiveness in meeting target levels, risk of exposure during remedial action, permanence of the action, compliance with relevant laws and regulations, and input from local





officials. If the targets are based on any exposure scenario other than that presented in risk exposure scenario “A”, proof of compliance with existing and planned future zoning and institutional control requirements, as specified in Appendix E, must be submitted as part of the remedial action plan.

### **C. Implementing the RAP**

Once the department has concurred in writing with the proposed TARC values, and the proposed RAP, the user should observe the following guidelines while conducting remedial action:

1. Obtain all necessary permits, and comply with all applicable local, state, and federal laws and regulations;
2. Develop detailed design specifications for installation and operation of the selected measures;
3. Continue the remedial action until such time as confirmatory sampling indicates that concentrations of the contaminants of concern are not above the approved target cleanup levels at the points of compliance and/or source areas. At any time during the remedial action:
  - a) If site conditions change or new data becomes available (e.g., more refined groundwater parameters or new toxicity data for the contaminants of concern) that could impact the approved STARC value, the user or the department may request that new STARC values be calculated.
  - b) The site may be evaluated using a different Tier, in accordance with the process outlined in the previous Steps.
  - c) The user must request and obtain written department approval for any significant changes to the approved RAP before the change is made; and
4. Attainment of remedial goals should be demonstrated by taking confirmatory samples of all affected media (e.g. soil and/or groundwater, etc.) Details on confirmatory sampling and performance criteria will be discussed in a separate guidance document. In general, all sampling locations in all media must meet the cleanup goals to obtain closure.

### **D. Monitoring**

Ongoing monitoring is sometimes necessary to demonstrate the effectiveness of remedial actions or to verify that contaminant levels have not increased. Once monitoring has shown that the cleanup is complete (i.e. that contaminant concentrations in the various environmental media at the points of compliance are not above the STARC or GTARC), no further action is required. Monitoring



requirements include, but may not be limited to:

1. If concentrations of contaminants of concern in soil decrease asymptotically and remain above the approved STARC at the points of compliance after the time specified in the approved remedial action plan, monitoring must continue until the user:
  - a) Upgrades the remedial action system to further reduce the level of the contaminants of concern; or
  - b) Chooses to conduct further Tier evaluation (unless already at Tier 3); or
  - c) Proposes a plan to eliminate exposures through institutional or engineering controls.
2. In some cases ongoing groundwater monitoring is necessary. Groundwater monitoring may be required to demonstrate that contaminant concentrations at the point(s) of compliance are below the approved GTARCs for a minimum of four consecutive quarters (or as determined appropriate by the department based on site-specific conditions). For example, if contaminants of concern have been measured in groundwater above the GTARC level on site, monitoring may be necessary to:
  - a) demonstrate that contaminants are not moving off-site at levels above the cleanup targets;
  - b) confirm modeling predictions of contaminant transport and attenuation; or
  - c) contaminant levels have decreased below the groundwater cleanup levels following soil or groundwater remediation
3. Engineering controls that are part of the remedial action (e.g. physical barriers, capping, hydraulic control, etc.) often require maintenance and monitoring to ensure integrity and continued performance. Use of such engineering controls require that an appropriate institutional control be used as described in Appendix E. Any maintenance required to ensure the integrity and continued performance of the engineering controls is the responsibility of the holder of the title, or his/her assignee. Any degradation in the engineering control which renders it ineffective could result in penalties as outlined in Appendix E.

### **3.10 Final CALM Report**

After completing the CALM process (as described in section 3 and applicable appendices), a final report must be prepared and submitted to the department for approval. The report must include all of the data collected to support the CALM decisions that were made. The exact report content will depend on the specific site and the Tier evaluation. The CALM report will typically include, but may not be limited to, the following information:



### Components of a Final CALM Report

- An executive summary;
- A general site description;
- A summary of site ownership and use;
- A summary of past releases or potential source areas;
- A summary of current and completed site investigative and remedial activities;
- A description of regional and site-specific hydrogeologic conditions;
- A scaled map of the site showing the location of facility or site structures (e.g. aboveground storage tanks, underground storage tanks, waste management areas, buried utilities and conduits, suspected/confirmed sources);
- An extended site map to include significant nearby features (e.g., local land use, ground water wells);
- A ground water elevation (potentiometric) map;
- Geologic cross-section data;
- Contaminant concentration data: e.g. isoconcentration maps, tables and graphs of spatial and temporal contaminant trends;
- If impact to groundwater is a concern, a list of all known wells in the vicinity of the site, along with construction details and descriptions of their current uses;
- A conceptual model of the site summarizing in graphical and narrative formats contaminant source(s), distribution, fate, and transport;
- Site photographs (actual prints or high quality color copies);
- A copy of the laboratory analytical data;
- A summary of the analytical data;
- A summary and discussion of the site assessment, and a summary of the ecological risk assessment;
- A summary of the Tier evaluation to include, but not necessarily limited to, exposure scenario classification, selection of Tier 1 STARC values, calculation of Tiers 2 and 3 STARC values (if applicable);
- A summary of reasonably anticipated use;
- Copies of documents sufficient to provide an assurance of future land use;
- A summary of the remedial action performed including demonstration of achieving the approved cleanup target(s);
- If institutional controls or engineering controls are used, a copy of the restrictive covenant and contract (see Appendix E);
- Description of ongoing monitoring plan (if applicable); and
- Results of any monitoring performed.

When cleanup levels have been achieved at the points of compliance and/or source areas, and monitoring and site maintenance are no longer required, then no further action is necessary at the site except to ensure that institutional controls, if required, remain in place. When the user has demonstrated to the department that all objectives and requirements have been met, and the department has concurred, a Certification of Completion or “No



Further Action” Letter (NFAL), signed by the director of the Missouri Department of Natural Resources’ Division of Environmental Quality, will be issued.

### **3.11 Certification of Completion: the No Further Action Letter**

The Certification of Completion, commonly referred to as a No Further Action Letter or NFAL, is DNR’s official closure notice for sites remediated under the Voluntary Cleanup Program. The NFAL may take any of several forms depending on the individual site. Generally, it includes a brief statement that remediation (if performed) has been completed, the sites meets the established cleanup goals, and no further remedial action is required. Depending on the situation, the NFAL will include the following:

1. Specification of media types contaminated;
2. General location of the contamination;
3. Specification of contaminants or contaminant types present;
4. Remediation has been completed [or] no remediation was necessary;
5. Statement that sampling results, provided in a report (date and author) indicated the contaminant levels are below the standards established for the site;
6. Reference to DNR files related to the project;
7. Statement that a restrictive covenant has been established and the certification of completion is contingent on fulfillment of the requirements of the restrictive covenant and monitoring contract (if applicable). This may include future land use, maintenance of engineering controls, and any monitoring or periodic sampling; and
8. “Reopener clause”: Statement that the department may require future investigation or remediation if contamination is discovered that was not discovered by the site investigation or was not addressed by the cleanup.

The NFAL can be denied or later rescinded if it was obtained through fraud or misrepresentation. Also, the NFAL does not provide liability release for any future hazardous substance releases. Two examples of NFALs are shown in Attachments 1 and 2.



**Attachment 1**  
**Example (Generic) VCP Certification of Completion**

RE: Certification of Completion, Hazardous Substance Environmental Remediation of the  
(site name, city, state)

Dear \_\_\_\_\_:

The final report dated \_\_\_\_\_ for the \_\_\_\_\_ site has been reviewed. This is to certify that no further action is needed at the \_\_\_\_\_ site related to the contamination identified in the environmental site assessments and for which remedial action has occurred under the oversight of the Voluntary Cleanup Program.

Site assessments revealed the existence of \_\_\_\_\_ contamination (in part of the site/across the site/in soil and groundwater/in surface and subsurface soil/in subsurface soil and groundwater/in subsurface soil/etc.) on the site. Actions were taken to remediate the site in accordance with the department-approved remedial action plan. (Explain briefly the type of remedial action conducted). The department determined that the remedial actions were adequate to (remove the contaminants from the property/decrease contaminant levels to acceptable levels/etc.).

Complete files concerning the investigation and remediation of this site are maintained at the offices of the Missouri Department of Natural Resources, Hazardous Waste Program, in Jefferson City, Missouri under the file name \_\_\_\_\_.

Should future monitoring or other investigations at or near the subject property find that additional contamination is present that was not identified or addressed during the investigations and remedial actions that are referred to in this letter, the department may require additional investigation and remedial action in the future.

Thank you for participating in the Voluntary Cleanup Program.

Sincerely,

DIRECTOR, DIVISION OF ENVIRONMENTAL QUALITY



**Attachment 2**  
**Example (Generic) VCP Certification of Completion**  
**with Restrictive Covenant**

Certification of Completion, Hazardous Substance Environmental Remediation of the  
(site name, city, state)

Dear \_\_\_\_\_:

The final report dated \_\_\_\_\_ for the \_\_\_\_\_ site has been reviewed. This is to certify that no further action is needed at the \_\_\_\_\_ site related to the contamination identified in the environmental site assessments and for which remedial action has occurred under the oversight of the Voluntary Cleanup Program. This Certification of Completion is contingent on the conditions in the restrictive covenant and in the contract being met now and in the future. A copy of the contract and the restrictive covenant are attached hereto and made a part hereof. A copy of this letter, in its entirety, has been recorded in the property chain of title.

Failure to comply with the conditions of either the restrictive covenant or the contract may result in this letter being declared null and void. Should this occur, an additional notice will be placed in the property chain of title by the department. (If only part of the site was addressed, a survey must be attached and appropriate wording used in the opening paragraph to explain that only part of the site was addressed).

Site assessments of the property revealed the existence of \_\_\_\_\_ contamination (on the \_\_\_\_\_ part of the site/across the site/in soil and groundwater/in surface and subsurface soil/in subsurface soil and groundwater/in subsurface soil/etc.) on the site. Actions (explain, briefly, the type of remedial action conducted) were taken in accordance with the department-approved remedial action plan to remediate the site. The department determined that the remedial actions taken were adequate to (remove the contaminants from the property/decrease contaminant levels to acceptable levels/etc.). Cleanup levels attained have been determined to be protective of human health and the environment given the (commercial or industrial) use of the property. However, because unrestricted use (Scenario A) cleanup standards, as specified in the department's guidance document *Cleanup Levels for Missouri, July 1998*, were not attained, the attached restrictive covenant was required by the department to protect human health and the environment from exposure to the remaining contamination. (If contaminants beneath building or cap, etc., explain here)

The contract entered into by  (property owner)  is an integral part of the department's approval of the remedial actions taken at the site. Future owners of this property will be



expected to enter into a similar contract with the department to facilitate the department's ability to ensure the conditions of the restrictive covenant are being met.

Should future monitoring or other investigations at or near the subject property find that additional contamination is present that was not identified or addressed during the investigations and remedial actions that are referred to in this letter, the department may require additional investigation and remedial action as necessary. Further, should the department determine that the conditions set forth in the attached restrictive covenant or contract be breached, the department may declare this letter null and void through the placement of an additional notice in the property chain of title.

Complete files concerning the investigation and remediation of this site are maintained at the offices of the Missouri Department of Natural Resources, Hazardous Waste Program, in Jefferson City, Missouri under the file name \_\_\_\_\_.

Thank you for participating in the Voluntary Cleanup Program.

Sincerely,

DIRECTOR, DIVISION OF ENVIRONMENTAL QUALITY



## REFERENCES AND RELATED DOCUMENTS

- American Conference of Governmental Industrial Hygienists. *Threshold Limit Values*, (latest edition).
- American Industrial Health Council. 1994. *Exposure Factors Sourcebook*.
- American Society for Testing and Materials. *New Standard Guide for Remediation by Natural Attenuation at Petroleum Release Sites*, E50.01 (96-01).
- American Society for Testing and Materials. *Provisional Standard Guide for Accelerated Site Characterization for Confirmed or Suspected Petroleum Releases*, PS3-95.
- American Society for Testing and Materials. 1994. *Standards on Groundwater and Vadose Zone Investigations*, Second Edition, Publication Number 03-418094-38.
- American Society for Testing and Materials. 1995a. *Guide for Developing Conceptual Site Models for Contaminated Sites*, E1689-9.
- American Society for Testing and Materials. 1995b. *Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites*, November.
- American Society for Testing and Materials. 1995c. *Standards on Environmental Sampling*, Publication Number 03-418095-38.
- Boulding, J.R. 1994 *Description and Sampling of Contaminated Soils :A Field Guide, (revised and expanded 2nd edition)*, Lewis Publishers, Chelsea, MI.
- Cowherd, C., G. Muleski, P. Englehart, and D. Gillette. 1985. *Rapid Assessment of Exposure To Particulate Emissions From Surface Contamination*. EPA/600/8-85/002. NTIS PB85-192219. Office of Health and Environmental Assessment, U.S. Environmental Protection Agency, Athens, GA.
- Freeze, R.A. and J.A. Cherry. 1979. *Ground Water*, Prentice-Hall Publishing Co., Englewood Cliffs, N.J.
- Mausbach, M.J. 1992. Soil Survey Interpretations for Wet Soils. *Proceedings of the Eighth International Soil Correlation Meeting (VII ISCOM)*:





*Characterization, Classification and Utilization of Wet Soils*, J.M. Kimble (ed), USDA, Soil Conservation, National Soil Survey Center, Lincoln, NE, p. 172-178.

Missouri Department of Natural Resources' Hazardous Waste Program. 1996. *Underground Storage Tank Closure Guidance Document*, March.

Missouri Department of Natural Resources' Division of Environmental Quality. *Standard Operating Procedures, SOP # MDNR-FSS-001, Recommended Containers, Volumes, Preservatives, Holding Times and Special Sampling Considerations*.

Missouri Natural Areas Committee. 1987. *The Terrestrial Natural Communities of Missouri*, (revised edition).

Missouri Secretary of State Division of Administrative Rules. *Code of State Regulations*, Title 3, Division 10, Chapter 4.

Missouri Secretary of State Division of Administrative Rules. *Code of State Regulations*, Title 10, Division 20, Chapters 10-13.

Missouri Secretary of State Division of Administrative Rules. *Code of State Regulations*, Title 10, Division 25, Chapters 1-15.

Missouri Revisor of Statutes. *Revised Statutes of Missouri*, Chapter 260, Sections 260.003-260.575.

Missouri Revisor of Statutes. *Revised Statutes of Missouri*, Chapter 319, Sections 319.100-319.139.

National Fire Protection Association. *Leakage and Repair Safeguards for Flammable and Combustible Liquids*, NFPA 329.

National Research Council. 1990. *Ground Water Models Scientific and Regulatory Applications*. National Academy Press, Washington, D.C.

Tidball, Ronald R. 1984. *Geochemical Survey of Missouri*, U.S. Geological Survey Professional Paper 954-H,I, Washington, D.C.

U.S. Environmental Protection Agency. *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods; SW-846*, (most recent edition).



- U.S. Environmental Protection Agency. 1986. *RCRA Groundwater Monitoring Technical Guidance Enforcement Document*.
- U.S. Environmental Protection Agency. 1988. *Selection Criteria for Mathematical Models Used in Exposure Assessments: Ground-water Models*. EPA/600/80-88/075, Washington, D.C.
- U.S. Environmental Protection Agency. 1989a. *Ecological Assessment of Hazardous Waste Sites: A Field and Laboratory Reference Document*, EPA/600/3-89/013, NTIS No. PB89205967, March.
- U.S. Environmental Protection Agency. 1989b. *Exposure Factors Handbook*, EPA 600/8-89/043, July. Draft update 1996 also used.
- U.S. Environmental Protection Agency. 1989c. *RCRA Facility Investigation (RFI) Guidance*. Interim Final. Office of Solid Waste, Waste Management Division, EPA 530/SW-89-031, May.
- U.S. Environmental Protection Agency. 1989d. *Risk Assessment Guidance for Superfund*, Volume 1, Human Health Evaluation Manual, Part A, EPA/540/1-89/002, December.
- U.S. Environmental Protection Agency. 1989e. *Risk Assessment Guidance for Superfund*, Volume 2: Environmental Evaluation Manual, EPA/540/1-89/001, NTIS No. PB90155599, March.
- U.S. Environmental Protection Agency. 1991a. *Compendium of ERT Groundwater Sampling Procedures*, Office of Emergency and Remedial Response, January.
- U.S. Environmental Protection Agency. 1991b. *Compendium of ERT Soil Sampling and Surface Geophysics Procedures*, Office of Emergency and Remedial Response, January.
- U.S. Environmental Protection Agency. 1991c. *Compendium of ERT Waste Sampling Procedures*, Office of Emergency and Remedial Response, January.
- U.S. Environmental Protection Agency. 1991d. *Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors*, OSWER Directive No. 9285.603, NTIS No. PB91921314, March.



- U.S. Environmental Protection Agency. 1991e. *Removal Program Representative Sampling Guidance, Volume I - Soil*, Office of Emergency and Remedial Response, November.
- U.S. Environmental Protection Agency. 1991f. *Risk Assessment Guidance for Superfund*, Volume 1, Human Health Evaluation Manual, Part B: Development of Risk-Based Preliminary Remediation Goals, OSWER Directive No. 9285.7-01B, NTIS No. PB9296333, December.
- U.S. Environmental Protection Agency. 1991g. *Site Characterization for Subsurface Remediation*, (Seminar Publication).
- U.S. Environmental Protection Agency. 1992a. *Guidelines for Exposure Assessment*, Fed. Reg. 57, #104, p.22888-22938, May.
- U.S. Environmental Protection Agency. 1993a. *Guidance for Evaluating the Technical Impracticability of Ground-Water Restoration*, Directive 9234.2-25, September.
- U.S. Environmental Protection Agency. 1993b. *Integrated Risk Information System (IRIS)*, October. Updates through March 1998 were used.
- U.S. Environmental Protection Agency. 1993c. *Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons*, EPA/600/R-93-089.
- U.S. Environmental Protection Agency. 1993d. *Provisional Guidance for Quantitative Risk Assessment of Polynuclear Aromatic Hydrocarbons*. EPA/600/R-93/089.
- U.S. Environmental Protection Agency. 1994a. *Guidance Manual for the Integrated Exposure Uptake Biokinetic Model for Lead in Children*. EPA/540/R-93/081. Office of Solid Waste and Emergency Response.
- U.S. Environmental Protection Agency. 1994b. *Assessment Framework for Ground-Water Model Applications*. EPA/500/B-94/003. Office of Solid Waste and Emergency Response.
- U.S. Environmental Protection Agency. 1995. *Health Effects Assessment Summary Tables (HEAST)*, OSWER OS-230.
- U.S. Environmental Protection Agency. 1996a. *PCBs: Cancer Dose-Response*



*Assessment and Application to Environmental Mixtures*. National Center for Environmental Assessment, Office of Research and Development, NCEA-W-059.

U.S. Environmental Protection Agency. 1996b. *Proposed Guidelines for Ecological Risk Assessment*, Fed. Reg. 61, #175, p.47552-47631, September.

U.S. Environmental Protection Agency. 1996c. *Soil Screening Guidance: Technical Background Document*, EPA/540/R-95/128, May.

U.S. Environmental Protection Agency. 1996d. *Soil Screening Guidance: User's Guide*, EPA/540/R-96/018, April.

U.S. Office of the Federal Register National Archives and Records Administration. *Code of Federal Regulations*, Title 29 Part 1910: [U.S. Department of Labor] General Industry Standards.

U.S. Office of the Federal Register National Archives and Records Administration. *Code of Federal Regulations*, Title 29 Part 1926: [U.S. Department of Labor] Construction Standards.

U.S. Office of the Federal Register National Archives and Records Administration. *Code of Federal Regulations*, Title 40 Part 260: Hazardous Waste Management System: General.

U.S. Office of the Federal Register National Archives and Records Administration. *Code of Federal Regulations*, Title 40 Part 307: Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Claims Procedures.